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SOVIET AGRICULTURE — NO 10

(Selected Translations on Crops, Implements, and Livestock)

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Table of Contents

I. COMPLETE MECHANIZATION IN ALL BRANCHES OF AGRICULTURE

[Following is a translation of an article by I. Polevodin, Chief Designer, Administration of Agriculture Machine Building, Rostovskiy Sovnarkhoz, in the Russian-language newspaper Molot (Hammer), Rostov-na-Donu, 5 February 1960.]

A scientific technical meeting for drawing up coordinated recommendations on the long range development of designs of agricultural machines ended recently in Rostov. It was called by the State Committee on Automation and Machine Building of the Council of Ministers USSR, Gosplan USSR, and the Rostovskiy Sovnarkhoz. Scientific officials of institutes, designers of agricultural machine building plants, agricultural mechanizers, and sovnarkhoz representatives participated in the meeting, as has already been reported in Molot.

Comrade Krasnichenko, director of the All-Union Institute of Agriculture Machine Building, and Comrades Zhuk and Gerasimov, candidates of sciences, and other comrades delivered reports at the meeting. The reporters and speakers, who spoke at sections and plenary sessions, noted unanimously that we have the chance to complete the mechanization of agriculture in the next 15 years and thus to successfully implement the decisions of the December Plenum of the Central Committee CPSU.

The December Plenum, as is well known, set forth a grandiose program for a further rise in the country's agriculture. The task has been set for industrial officials --- to accelerate the tempo for equipping kolkhozes and sovhozes with new machinery for complete mechanization and on this basis to reduce significantly the time needed to do agricultural work and to raise the general culture of farming. The personnel of many design bureaus, including designers of Rostsel'mash/Rostov Agricultural Machine Building Plant/, the Taganrog Self-Propelled Combine Plant, Krasnyy Aksay, and the scientists of institutes are now working on a solution to this task.

The production of grain is one of the main problems in agriculture. This is perfectly understandable. We have about 60 percent of our planted area in grain crops. The process of harvesting grain has been mechanized. The combine method is the main method of harvesting. The S-6, RSM-8, and other combines proved to be good in their time. The SK-3 self-propelled combine replaced them and it is undoubtedly better at harvesting grain than the old type combines. However, the problem of harvesting grain has not yet been fully solved.

Ya. M. Zhuk, head of the laboratory of mechanization of grain harvesting of the All-Union Institute of Mechanization, was correct when he said at the meeting:

---We can not close our eyes to the fact that a series of rayons in our country, such as rayons of the Central Chernozem Belt, the Northwest [Economic Region], the forest district (Poles'ye), and the Far East, where tens of millions of hectares are planted in grain crops, are not provided with combines.

Only in the near future will agriculture of the Far East begin to get self-propelled crawler tractors. Work is going slowly on the development of a direct-flow combine for the Northwest [Economic Region]. Rayons in the foothills of the Caucasus, the Crimea, and the Transcarpathians do not possess the machinery necessary for the harvesting of grain. Mechanizers make great demands on the quality of self-propelled combines produced by our plants --- Rostsel'mash and the Taganrog Combine Plant.

It was pointed out at the meeting in particular that the machines being produced have been poorly automated as regards operation and that the self-propelled combine impedes the harvesting of straw, because during operation it scatters small heaps of straw into poorly formed rows. Designers intended that one man should tend the SK-3 self-propelled combine, but in the majority of cases two men tend it. The cost of this machine is still high and consequently its economic efficiency is low.

That is why it is necessary to continue work on the improvement of the design of the self-propelled combine. It should be kept in mind in this regard that this machine will be operating in agriculture for a long time to come.

The meeting declared itself for the use in agriculture of mounted and semi-mounted combines. In this regard, mention was made of the feasibility of using the SSh-65 self-propelled chassis in agriculture.

All the operations of working the soil have now been mechanized in agriculture. Trailer and mounted machines --- plows, cultivators, disc harrows, tillers, etc. --- are used extensively here. However, as was noted at the meeting, the load for one machine in the USSR is significantly more than abroad. For that reason, it is necessary to increase the inventory of soil working machines and to achieve an increase in their operating speeds. By 1965, the forward speeds will increase to 8-9 km/hr and this will make it possible to raise the productivity of the machines significantly.

A. V. Krasnichenko, director of the All-Union Institute of Agricultural Machine Building, said at the meeting that in the next 10 years the speed of plowing and other soil working processes should be brought up to 15-16 km/hr.

This has a direct relationship to the designers of the Krasnyy Aksay Plant. They should labor creatively on the development of those operating parts of cultivators that will contribute to the further development of the country's agriculture.

As a result of the four-day meeting, participants generalized the domestic experience of agricultural machine building and offered their recommendations for the next 15 years. The meeting suggested that all research work and experimental-design work be directed to the creation of mounted machines for tractors and self-propelled chassis, and also to the creation of semi-mounted and self-propelled machines, operated by one man and designed for work at high speeds.

Windrowers and self-propelled mounted or semi-mounted pickup combines will be used extensively in the two-stage harvesting of grain. For harvesting straw and chaff, it has been recommended to use sweep rakes in set with a tractor hay shock carrier and hay stacker and to use hay stack formers that mechanically distribute and pack the straw.

It is recommended that scientific-research work and experimental-design work be directed to the development of an efficiently designed reaping machine that packs the grain plants into well ventilated, tent shaped rolls for the two-stage harvesting of the crop. New means and methods of harvesting grain crops will be sought after. It is planned to increase scientific research work in the direction of the intensification of technological processes of cleaning and drying grain and of organizing new universal high-production machines and aggregates for these purposes.

The December Plenum of the Central Committee CPSU has called for an increase in the production of grain to 10-11 billion poods per year. The successful implementation of this task will depend not only on agricultural workers, but also on our designers and the industrial officials of the Don. Their job is to create first class machines that operate at high speeds and to equip the country's agriculture with these machines.

II. IMPROVED MACHINES FOR AGRICULTURE

[Following is a translation of an unsigned article in the Russian-language newspaper Promyshlenno-Ekonomicheskaya Gazeta (Industrial Economic Gazette), Moscow 16 December 1959.]

The workers of our country are actively preparing for the opening of the December Plenum of the Central Committee CPSU.

USSR agricultural workers are celebrating the Plenum with great successes. Thousands of kolkhozes and sovkhozes, entire oblasts, krays, and republics this year are fulfilling delivery plans to the state of grain, meat, milk, cotton, wool, and other agricultural products ahead of time. Indeed this year was unfavorable as far as meteorological conditions are concerned.

Great merit in the development of kolkhoz and sovkhoz production belongs to the agricultural mechanizers who used their machinery intelligently.

"Our machine building industry, said N. S. Khrushchev at the 21st Party Congress, will equip agriculture with even better machines, which will allow kolkhozes and sovkhozes to obtain more output with fewer expenditures of labor and money. For this purpose, it is necessary to accelerate work on the creation of machine systems for the complete mechanization of working cotton, sugar beets, potatoes, vegetables, and other crops."

Scientific research institutes and design bureaus and plants of agricultural machine building are continuously working on the developments of these machines. Thus, cotton growers have received the new KhVS-1.2 machine which gathers up to 12 tons of cotton per day and takes the place of many pickers. Modern machinery is also being developed for harvesting potato fields. In addition to the KGB-2 trailer combine, the KVN-2 vibrating mounted potato picker and also the KUE-2 potato picker have been designed. The latest machinery will also make it possible to mechanize such a labor consuming process in agriculture as loading and unloading operations. For example, the BU-60 grain loader has been designed. It reduces labor expenditures in loading operations 13 times as compared with ZP-40 grain loader that is now in experience. New machinery is being developed for beet growers, vegetable growers, and those in other branches of farming.

Great inadequacies have still not been eliminated however in the operation of a number of scientific research institutes and enterprises. Not long ago the Taganrog designers created a machine that has great maneuverability and it was extremely convenient in service --- the SK-3 combine.

But between the design plan and performance there was a great difference. In the last two months, more than four thousand written complaints have been made against the low quality of production of this machine by the Taganrog, Rostov, and Krasnoyarsk plants.

The most vulnerable subassemblies and parts in the new combine are: the SDM-7 engine produced by the Khar'kov Serp i Molot Plant, the pistons manufactured by the Avtotraktordetal' Plant (Tambovskiy Sovnarkhoz), lines manufactured by the Sinarskiy Plant (Sverdlovskiy Sovnarkhoz), and V- belts from the Yaroslavl' Industrial Rubber Products Plant. Many parts, which the combine plants make themselves, are also unreliable.

Numerous commissions have unanimously established that more than 20 improvements should be made in order that the SK-3 combine finally becomes a machine meeting present requirements.

Unfortunately, the SK-3 is not the only one that has been unsuccessful.

The low quality of production of models of new self-propelled chassis by the Vladimir and Lipetsk plants should also be noted.

Agricultural mechanizers remember unkindly the KRN-4.2 cultivator manufactured in the Tatarskiy Sovnarkhoz, the RZh-1.7 manure spreader (zhizhepazbrasyvatel') produced by the L'vovsel'mash Plant, the ZhB-4.6 reaping machine of the Tula Combine Plant, the straw-ensilage cutter manufactured by the Kurgansel'mash Plant, the potato digger of the Estonian Voyt Plant, etc.

All this testifies to the need of greatly improving the quality of designing and manufacturing machines.

A number of sovnarkhozes, especially the Tul'skiy, Kiyevskiy, and Dnepropetrovskiy sovnarkhozes, violate the decree confirmed by GNTK [State Scientific Technical Committee] of the USSR on the procedure for developing, manufacturing, and testing experimental models of agricultural machinery.

A characteristic example. The SKOSSh-2.8K combination vegetable check-row planter designed by the Krasnaya Zvezda Plant of the Kiyevskiy Sovnarkhoz should have been sent for testing at the beginning of April, i.e. by the beginning of planting. It was sent on the 5th of June. It had been proposed that it be tested in the planting of 30 hectares of vegetables. Actually it was restricted to 7 hectares and then in the planting of corn. All the same, in the test certification they acknowledged the possibility of accepting the planter for series production, if the faults that had been noted were eliminated. Incidentally more than two dozen were found.

The established procedure for conducting tests of new agricultural machinery should be rigidly adhered to. Each machine should be sent to the test station at appropriate agricultural periods, after it has undergone all the plant tests.

Our designers have a great debt to the animal husbandry raisers, especially those in the arid regions of our country. They need high-quality water-hoisting mechanisms, movable watering stations, water carriers, and pumping equipment. However, the development of machines for the complete mechanization of operations in animal husbandry is lagging.

Important problems stand before the creators of new agricultural machinery. Each scientific research institute, design bureau, and plant during this time of preparing for the Plenum must even more raise their creative activity, search out and utilize every possibility for increasing the output of modern agriculture machinery.

The Stalingrad tractor builders are a worthy example. They are making a persistent effort to produce 3,000 tractors and 12 million rubles of spare parts above the plan this year. The Stalingrad tractor builders in 1960, in spite of an increased assignment, are obligated to produce three thousand machines above the plan and they have called upon other tractor plants in the country to follow their example.

To emulate this initiative of giving kolkhozes and sovkhozes more modern machinery is the patriotic duty of all workers in the agricultural machine building industry.

III. EXPANSION OF THE PLANTING OF FODDER LEGUMES

[Following is a translation of an article by M. P. Yelsukov, Corresponding Member, VASKhNIL (All-Union Academy of Agricultural Sciences imeni Lenin), in the Russian-language periodical Zhivotnovodstvo (Animal Husbandry), Moscow, March 1960, Pages 42-43.]

The presence of albumin in fodders is closely connected with the specific composition of plants. An increase in the total harvests of fodders by the yield of such highly productive crops as corn in no way eliminates the problem of increasing the planting of high albumin crops. The amount of fodders and their qualitative side should be decided in a different way in the various zones, depending on a whole range of conditions. However no place should forget about the production of vegetable albumin --- the basis of a rich diet for livestock.

A number of republics and oblasts are successfully deciding the problem of increasing fodder albumin by planting fodder legumes. According to the reports of experimental institutions and of kolkhozes and sovkhozes, fodder legumes are being planted successfully in the West and Southwest USSR, in Belorussia, in the Ukraine on the right bank of the Dnieper River (Pravoberezhnaya Ukraina), in the western approaches to the Urals in the central non-chernozem and chernozem oblasts, in mountainous regions of Central Asia and the Transcaucasus, and also in Siberia and the Far East. To ensure livestock with vegetable albumin, broad beans can be supplied in all regions of lupine growing and the two do not contradict each other. If lupines do well on light sandy and sandy loam soils, then broad beans, on the other hand, do well on more firm loamy soils. Figuratively speaking, legumes are lupines, but on firm soils. These two crops as it were complement each other.

According to our data, leguminous grain contains 31 percent albumin. There are varieties in which the content of albumin is even higher. The following results were obtained by the Institute of Fodders when comparing beans for grain with other leguminous crops (table).

Legumes are in first place as regards the harvest of albumin according to calculations. It is interesting to note that the institute did not get a legume grain yield less than 20 centners per hectare according to data computed over a number of years. The Iygevaskaya Experimental Station in the Estonian SSR gets a legume grain yield of up to 50 centners per hectare. Yields of 30-40 centners per hectare are well known in practice.

Content of Albumin in the Grain Yield of Various Crops

Crop	Grain Yield (centners/hectare) Total	Albumin (%) In Leguminous Component	In Cereal Component
Vetch and Oats	14.8	29.62	12.0
Fodder Peas and Oats	14.8	23.94	12.0
Yellow Lupine	13.7	40.87	---
Broad Beans	28.3	31.25	---

Legumes can be used as fodder for livestock not only as a type of grain, but also as a type of ensilage. The addition of leguminous plants when they are ripening to ensilage containing carbohydrates makes it possible to obtain excellent ensiled fodder, suitable for all types of livestock, but also fodder rich in albumin. About 10 kg of digestible protein is contained in 100 kg of such ensilage in its dry state.

It is also well known that green fodder legume plants can be used as fodder for hogs when they are pastured. This plant can be used on a green conveyer for the hogs.

In addition to the qualities mentioned, legumes at the same time can be included in that number of first class forerunners for other crops. The combination of their nitrification capacity with the high content of albumin in the grain is evidence of the great advantage of legumes over a number of other crops. It is possible to judge the nitrification capacity of legumes by the following data, obtained experimentally in our institute. The amount of nitrates (in mg of nitrogen per 1 kg of soil) was: after legumes-5.02, after fodder peas and oats-4.44, and after vetch and oats-4.72.

Because the question has been raised about the extensive planting of fodder legumes, special attention should be devoted to the production of their small seed shapes. Their planting can be mechanized by the use of ordinary grain planters with wide-row, dense sowing, or by the use of planters that are used for corn planting using the check-row method. Our experiments, made in 1959, show that the check-row method of planting legumes should be the main one when planting them for fodder purposes. We planted legumes by the check-row method in a 50 x 50 cm pattern: one, two, three, four, and five grains per hill. In view of the tendency of legumes to branch out, there were more fertile vines in each hill as a final result.

When doing this, the best results were obtained when 4-5 grains were planted per hill. In addition to the high yield, there was a rapid ripening of the plants. This, as is well known, is more important.

The use of small-seed forms of legumes with an absolute weight of about 400 grams, when they are check-row planted, require a total of 80-90 kg of seed per hectare instead of 180-200 kg, when there is wide-row dense planting. The yield of grain does not decrease. This is one of the most important advantages, because the expenditure of planting material decreases two times.

The combined planting of legumes with corn can be worthwhile (the planter plants corn in one pass and in the other, legumes). The harvesting of such a mixed crop for silage can be done by going across the rows opposite to the way it was planted and thus the crop is mixed before it is loaded into the silo. This method of planting and harvesting makes it possible to enrich the corn plants with albumin by means of legumes.

Good results have been obtained by us in experimental planting by planting beans with sunflowers, vetch, and oats. It is wise to plant them with such leguminous plants as vetch and fodder peas which need support during the vegetation period. Such a mixture, consisting of leguminous components, is extremely rich in albumin and can be used in repeated plantings.

As regards the agricultural techniques of raising high yields of fodder legumes, it can put outlined in the following way: in crop rotation legumes are put in after the plants that have gotten organic fertilizer. The working of the soil prior to planting is done in the same way as for other crops planted in the spring. Legumes respond well to the combined application of phosphorus-potassium fertilizers and especially to the liming of soils with excess acidity.

When raising legumes for grain, they are planted in the spring at the same time as the early grain crops. Late planting is worthwhile only for getting green plants. The seeds of legumes can be put into the ground rather deeply ---- 5-6 cm. As was indicated previously, the check row method is the best way of planting legumes. The arrangement of the plants can be 60x60 and even 70x70 when there are four-five grains per hill.

Ordinarily one and a maximum of two between row workings lengthwise and crosswise is sufficient for beans, because growth in the first period after germination is rather rapid and the rows close up quickly.

The fact that small areas of fodder legumes are not planted by mechanized means can be attributed to the fact that to a great extent large seed shapes are used as garden crop. The use in planting of small-seed beans will eliminate this.

The amount of labor for harvesting and drying is another reason for slowness in planting beans, since all leguminous plants, including fodder legumes, quickly become moldy and spoil if they are not dried adequately.

Fodder legumes can be stored successfully by putting them in a silo irrespective of the vegetation period, but not later than the waxen stage. It is possible to harvest by ensilage and grain combines. As regards to seed grain, it is necessary to leave a seed area of not more than 2.5-3 hectares in order to ensure the planting of 100 hectares. It is possible to harvest the grain yield from such an area on time and to bring it up to planting conditions by ordinary means.

It is desireable to check the drying process of the beans by putting the grain crops with dry straw into stacks. The thrashing then can be done in a period when all the other work has been done.

The job now is to expand the planting of small-seed beans as an extremely valuable high-albumin crop for livestock fodder in addition to high-yield fodder crops. Together with an expansion in the planting of beans, it is necessary to perfect the agricultural techniques of working them in accordance with soil and climatic conditions.

IV. SYNTHETIC SUBSTITUTE FOR ALBUMIN

[Following is a translation of an article by I. Matus, Chief Zootechnician, Luganskaya Oblast Administration of Agriculture, in the Russian-language periodical Kolkhoznoye Proizvodstvo (Kolkhoz Production), Moscow, No 12, December 59, Pages 24-57.]

It is possible to replace up to 25-30 percent of the albumin in the daily ration of ruminants with urea according to information supplied by scientific research institutes and kolkhozes and sovkhozes. Production tests on feeding urea to cows and calves have been made in kolkhozes of the Luganskaya Oblast in order to study the effectiveness of using it for fodder. They are now feeding urea to more than 12,000 cows and 17,000 calves in farms of kolkhozes of the oblast.

They mix urea with various fodders, but most often with silage. When doing this, the norms and rules of feeding are strictly adhered to. They give 100-120 grams of urea to one cow per day on the average, and 30-40 grams per centner of weight to the calves. They accustom the livestock to the urea gradually, at first small doses (10-15 grams per day per head) are given, then gradually, in 7-8 days for grown animals and 10-12 for the young animals, the full amount is given. The first 2-3 days fodder, mixed with urea, is given once a day, and then 2-3 times.

They mix dry urea or a solution of it both with concentrates and with silage. When mixing dry urea, they grind it up, making sure that all the lumps are pulverized. When making a solution, 5 liters of warm water (40-60 degrees) is used for a kilogram of urea. The solution is filtered through two layers of gauze or through a fine strainer and diluted with cold water to an extent necessary for the normal moistening of the fodder. When moistening silage, it is not necessary to dilute the concentrated solution.

Wooden boxes measuring 1.50 x 70 x 40 centimeters are used for mixing urea with concentrated fodders (kontskormy). The solution is prepared not more than an hour before the fodder is moistened. The solution should not be prepared earlier, because the urea will seperate out with liberation of ammonia gas. The moistened fodder is fed to the livestock immediately.

Urea is used from the start of the time livestock are kept in stalls in the Rodina Kolkhoz of the Novo-Aydarskiy Rayon. The cows in the kolkhoz are fed as follows (kilograms per head during a day): meadow hay-2, ground corn stalks-6, corn silage-30, sunflower oil cake-0.4, ground corn ears-2.6. In such a ration there are 11.53 fodder units and 869 grams of digestible albumin - 76 grams per fodder unit. With an average daily milk yield of 12.3 kg, 11.5 fodder units and 1,200 grams of albumin are required per head per day. Thus, there are 331 grams of albumin short in the ration.

They have compensated for the lack of albumin in the diet by the addition of urea. Two groups of cows were selected for the experiment with a similar lactation period, daily milk yield, and weight --- 12 animals in a group. They gave 100 grams of urea a day to each cow. They were fed a full dose on the tenth day after the start of the experiment. This is how the average daily milk yield of the cows in the experimental (opytnaya) and check (kontrol'naya) groups changed (see following table)

Average Daily Milk Yields of Cows in Experimental and Check Groups
(in liters per head)

Periods	Experimental Group	Check Group
Prior to the feeding of urea	13.2	13.2
Fifth day	13.5	13.1
Tenth day	14.1	13.3
Twelfth day	14.0	13.3
Fourteenth day	14.2	13.2
Fifteenth day	14.5	13.1
Sixteenth day	14.7	13.3
Seventeenth day	15.0	13.4
Twentieth day	14.8	13.2

Milk yields increased during the 15-17 days after the start of the feeding of urea and later on remained at 1.6-1.8 kilograms higher than in the check group. When the urea is discontinued, it caused a decrease in the productivity of the cows.

All the kolkhozes of the Novo-Aydarskiy Rayon are now using urea. Kolkhozes of the Verkhne-Teplovskiy Rayon are also having good results, where the milk yields have increased by 1-1.2 liters. In the Pobeda Kolkhoz of the Krasnodonskiy Rayon, the Kolkhoz imeni Zhdanov of the Belokurakinskiy Rayon, the Kolkhoz imeni Lenin of the Roven'kovskiy Rayon, and in many others, the daily milk yields increased by 1-1.5 liters per cow after urea was utilized.

The use of urea in fattening cattle deserves special attention. The Komintern Kolkhoz of the former Novo-Astrakhanskiy Rayon selected 450 calves for fattening. They added urea to the daily rations of the cattle --- 120 grams per head on the average. During March 1959, the daily weight gain for this group was (as computed for one animal) 1050 grams, whereas in the check group the average daily weight gain did not exceed 670 grams.

The Put' k Kommunizm Kolkhoz of the same rayon selected two groups of calves 6 months of age and older --- 30 calves per group. The total live weight of the calves of the first group on the 1st of February was 4,347 kilograms, and of the second --- 4,517 kilograms. Urea was added to the diet of the animals of the first group, and the second group was kept under similar conditions, but it was not fed urea. During February each calf of the first group gained an average of 630 grams per day, and each calf of the second group --- 395 grams.

With urea used on a wide scale for feeding livestock, there is not one case of poisoning. Animal husbandry workers are convinced how effective and useful it is to use synthetic substitutes for albumins. Work is now being done to simplify the methods of feeding urea. It is very convenient and economical to use urea for enriching corn silage with albumin. It is better to add urea during ensiling. The technique is quite simple; the corn ensilage is moistened uniformly with a solution of urea at ensiling.

V. TO HASTEN FULFILLMENT OF THE DECISIONS OF THE 21ST PARTY CONGRESS AND THE JUNE PLENUM OF THE CENTRAL COMMITTEE CPSU

[Following is a translation of an unsigned article in the Russian-language periodical Traktory i Sel' khozmashiny (Tractors and Agricultural Machines), Moscow, No 11, November 1959, Pages 1-3.]

All the Soviet people have received the decisions of the 21st Party Congress with a feeling of pride. The decisions have affirmed a magnificent program of development for all branches of the economy during 1959-1965.

The implementation of decisions will raise the industrial production of our socialist economy to a new height, will ensure a further rise in agriculture, will raise the material well being of the populace, and accelerate the building of a communist society.

The planned increase in agricultural output will make it possible to fully satisfy the growing demands of the populace for food products, and industry's demands for raw materials.

The expansion of mechanization and the further equipment of kolkhozes and sovkhozes with modern machinery are decisive conditions for the development of agriculture during the Seven Year Plan.

The June Plenum of the Central Committee CPSU has pointed out specific ways in its decisions, by means of which machine building should be developed to ensure fulfillment of the program of development of the economy planned by the 21st Party Congress. The Plenum decisions have charged tractor and agricultural machine building with the task of ensuring agriculture with machines that improve the complete mechanization of working and harvesting industrial crops, potatoes, and vegetables, the processing and drying of grain, the harvesting and transport of straw, the preparation and distribution of fodder, the supplying of water to farms, and also loading-unloading operations in agriculture.

These problems can not be solved by a simple quantitative increase in the output of machines that have already been mastered.

Designers of tractor and agricultural machine building must soon develop a number of the new, most important machines now lacking for the improvement of complete mechanization and carry out a fundamental modernization of designs of a large number of machines already mastered in production.

Both newly developed and modernized agricultural machines and tractors should possess high indices of economic efficiency, ensure a sharp rise in labor productivity, and contribute to a growth in yield and productivity.

In order to ensure the complete mechanization of agricultural production and the extensive utilization of tractors in transport operations, it is necessary to finish structural work and production setup, and to master the output of the new model T-56 and T-70 crawler tractors in 1962, and also modifications of them for operation on mountain slopes, in vineyards, and the timber economy.

The Bryanskiy Sovnarkhoz must increase the output of S-140 crawler tractors and the Chelyabinskiy Sovnarkhoz must finish work on the design and ensure the output in 1959 of the first experimental consignment of the DET-250 diesel electric tractor which has 320 horse power in order to ensure heavy reclamation and construction operations and to mechanize operations in industry.

The Lipetskiy Sovnarkhoz and the design bureau of the Lipetsk Tractor Plant must in accordance with test results accelerate the design and organize the series production of self-propelled chassis for various mounted agricultural machines for the extensive mechanization of cultivated crops.

It is necessary to accelerate the design and organization of series production of the SSh-45 and SSh-65 self-propelled chassis that have 45-50 horse power and 65-75 horse power engines for use with grain harvesting combines, various harvesting machines, self-unloading platforms.

The design organizations of tractor plants and NATI still have a great deal of work to do on raising the operating speeds of tractors. It is necessary to increase the transport speed of wheeled tractors to 22-25 km/hr and to equip them with special transport type devices, devices for attaching road-construction machines and loaders, and also with a reverse gear and it is necessary to ensure the more extensive utilization of tractors in transport operations.

It is also necessary to make changes in the transmission and moving parts, to improve the coupling qualities of wheeled tractors, to adopt a force feed (nadduv) for modernizing diesel engines and increasing their power, to reduce the size and weight of auxiliary engine units (air cleaner, fuel and oil filters, fuel feed apparatus, and others), and to develop small highly effective and reliable starters.

It is necessary to accelerate the work being done on unifying tractor engines, reducing their metal consumption, and raising fuel economy and service life.

Further improvement of agricultural machine designs will be accomplished by expanding the products-list of mounted machines, the creation of mounted machines for self-propelled chassis, and the utilization of a three-section system of assembling cultivating and planting machines with tractors. Simultaneously measures are to be taken to perfect the system of hydraulic operation of mounted and coupled machines.

Therefore, they should ensure fulfillment of the new processes required by advanced agricultural engineering and reduce losses to a minimum, i.e. contribute to an increase in the total harvest of agricultural production.

In addition to these most important qualitative indices, new and modernized designs of tractors and agricultural machines should also have a minimum weight in order to ensure the possibility of increasing the output of machines from that volume of materials that has been alloted by the control figures for the needs of tractor and agricultural machine building during the Seven Year Plan.

These general trends in the development of new designs and in the modernization of designs of tractors and agricultural machines should be implemented by all design organizations of tractor and agricultural machine building.

The clear-cut specialization of head design organizations was established by a decision of the government in 1958 and each of them is responsible for the development of a definite group of tractors and agricultural machines. The fact that specialization has been established has made it possible to propose specific tasks to each head design bureau.

Guided by the decisions of the December Plenum of the Central Committee CPSU in 1958, the decisions of the 21st Party Congress and the June Plenum of the Central Committee CPSU in 1959, head design organizations since the end of 1958 and during 1959 have intensified their work considerably, and increased their personnel and experimental production bases. This has improved their work.

To ensure fulfillment of the assigned volume of production and design work, republics, sovnarkhozes, plants, and design organizations must do a great part of this work in a short period of time.

The output of wheeled tractors with a simultaneous rise in the number of models should be increased in the field of tractor building during the Seven Year Plan.

The Khar'kovskiy, Lipetskiy, and Belorussian sovnarkhozes and the design organizations of tractor plants together with NATI [Motor Vehicle and Tractor Scientific Research Institute] should accelerate design development and ensure the output of four types (marka of wheeled tractors and the output of the TK-56 wheeled truck tractor (tyagach).

In addition to the development of new designs of crawler tractors, there should also be a modernization of crawler tractors now being produced by industry and a further improvement in their technical-economic indices.

In place of the obsolete KDP-35 tractor, a crawler tractor model will be developed in the same traction power class on the basis of a newly designed wheeled tractor.

It is also necessary to raise the operating speeds of machine tractor units in plowing, planting, and cultivating to 6-9 km/hr as against 3.5-4.5 km/hr which is now used.

Designs of automatic devices for operating agricultural machines and units, as well as hydraulic engines for operating parts should also be developed.

Among the basic measures to be taken for certain groups of agricultural machine, it is necessary to note:

Soil working machines and planting machines --- bring the output of mounted plows up to 87 percent and the output of cultivators up to 93 percent of the total amount of them produced together with an expansion in the type classification of plows, cultivators, and planters including planters for the precision planting of cotton and sugar beets.

Grain harvesting machines --- the change to the output of mounted combines for self-propelled chassis of 45-50 horse power and 65-75 horse power, the utilization of crawler combines and combines mounted on chassis with drive wheels for very moist regions, and also of combines for work on slopes, of combines equipped with mounted stackers and presses, with attachments for harvesting grain-leguminous crops, sugar beet and grass seed plants, sunflowers, soy, and others.

It is also necessary to ensure the development and production of pneumatic grain cleaning machines, grain loaders, grain cleaning machines for seed grain, and driers.

Corn picking machines --- to ensure complete mechanization of harvesting it is necessary to design and produce: a corn harvesting combine mounted on a self-propelled chassis that breaks off the ears, shucks them, and grinds the stalks, a universal corn harvesting combine for harvesting corn for grain and ensilage, and a number of other machines.

Machines for harvesting sugar beets --- to ensure additional measures for improving the designs of machines being produced and also to develop new, more modern designs: a beet harvesting combine for the continuous harvesting (potochnaya uborka) of beets without hard scraping of the roots when loading them for transport, a combine that trims away the beet tops, mounted loaders for tractor and self-propelled chassis, and unloaders.

The utilization of the continuous method of harvesting beets using new machines will lower labor expenditures to 7-8 man-days per hectare.

Machines for working and harvesting cotton --- to finish the development and to produce a complex of machines for completely mechanizing the process of raising and harvesting this crop and to replace a number of machines now being produced with more improved designs.

The successful fulfillment of the production plan in 1959 by the tractor and agricultural machine building industry shows that the assignments set by the 21st Party Congress CPSU on equipping agriculture with complete mechanization equipment is being fulfilled successfully, however the improvement of designs and the raising of the efficiency of machines are being implemented still at an unsatisfactory tempo.

The forthcoming Plenum of the Central Committee CPSU will consider the state of the mechanization of agricultural production, the equipment of kolkhozes and sovkhozes with improved machines and will place before the tractor and agricultural machine building industry a number of new, more complex tasks which must be solved for a further rise in the country's agriculture.

It is a matter of honor for scientific and engineer-technical officials of industry to mobilize all their energy, initiative, and creative ability to solve these new tasks successfully and in the shortest possible time.

VI. NEW MACHINES FOR BEET PRODUCTION

[Following is a translation of an article by V. I. Voronezhskiy, Chief Specialist, GNTK [State Scientific Technical Committee], Council of Ministers, Ukrainian SSR, in the Russian-language periodical Traktory i Sel'khozmashiny (Tractors and Agricultural Machines), Moscow, No 11, November 1959, Pages 24-26.]

The Ukrainian Scientific Research Institute of Agricultural Machine Building (UkrNIISKhOM) has created a new SKN-1.6 beet-harvesting combine (fig. 1) and the SKB [Special Design Bureau] of the Dnepropetrovsk Agricultural Machine Building Plant — the SKF-2 beet harvesting combine (fig. 2)

The SKN-1.6 and SKF-2 two-row trailer beet combines are used with the MTZ-5 tractor. They operate on the principle of a preliminary cutting of the leaves from the standing crop and this is their chief difference from the SKEM-3 beet combine which cuts away the leaves inside the machine. They are designed for operations in non-irrigated areas on 445 mm rows.

Diagrams of the process of sugar beet harvesting by the SKN-1.6 and SKF-2 are almost identical, but the operating parts, which perform the same operations, are different in design in each combine.

The basic subassemblies of the SKN-1.6 beet combine are shown in fig. 3.

The welded frame 1 rests on three wheels. The cutting apparatus consists of two disc blades, rotating toward each other, that are assembled on the small frame with a leaf conveyer. The rear part of the small frame is hinged to the main frame and the front part rests on a wheel 2. Runner tracers 3, connected kinematically with the blades, have been installed forward of the disc blades.

When the machine moves, the tracers set the blades at the right cutting height depending on the height of the root heads relative to the surface of the ground.

The rear ends of the runner tracers can move up to 50 mm to the right or left from the center of the row depending on the position of the roots in the rows.

The separation of the leaves from the blades and their removal to the hopper is done by one longitudinal conveyer and one transverse conveyer.

A root head scraper is located behind the cutting apparatus. It consists of two pairs of brushes that rotate from rubberized belts and is used for cleaning the remaing leaves and stems from the root heads.

The digging device consists of two pairs of plowshares 4 and four discs 5 that have been installed in front of the plowshares.

The roots taken out of the ground are fed onto a scraper-conveyer 6, where the soil is cleaned off of them.

The chain scraper type elevator 7 is located behind the scraper conveyer and is designed for feeding the cleaned roots into the hopper 8.

The raising and lowering of the operating parts of the beet combines is done by means of a hydraulic cylinder 9.

The operating parts are driven by the tractor power selection shaft through the distributor reduction unit 10.

The hoppers are opened by the tractor driver by means of handles and cables. The hoppers close automatically by the action of weights 11.

The cutting apparatus of the SKF-2 combine (see fig. 2) as distinct from the SKN-1.6 consists of a rotating forced-disc type tracer and a non-movable (passive) blade that is connected with the tracer.

The digging device is the same as on the SKN-1.6 beet combine. A cammed shaft is located behind it for loosening the earth and for feeding roots onto the conveyer grate.

The rod shaped conveyer feeds roots to the scraper which consists of five shafts with cams and one shaft (the last) with shaped discs that rotate toward the others. Earth and adulterants are hers cleaned from the roots. Later the roots are fed onto the loading conveyer which moves them side by side to a lorry. The leaves are collected in the hopper and as it fills up they are dumped automatically in the field in piles.

Operation of the SKF-2 combine along the rows is done automatically by means of a special hydraulic tracer device.

The beet harvesting combines just described underwent state tests at the Ukrainian Machine Testing Station in 1958.

The SKN-1.6 and SKF-2 beet combines were better in operation according to a number of indicators than the SKEM-3 beet combine with which they were compared. The beet roots were cleaned of soil better, there was practically no dirt on the leaves, and the leaves were cut better.

This year [1959], new beet harvesting combines are being produced in experimental consignments and will again be tested under production conditions.

The SOT-40A beet loader-cleaner which is mounted (fig. 4) with a productivity of up to 40 tons/hr has been developed by the SKB [Special Design Bureau] of the Dnepropetrovsk Agricultural Machine Building Plant. It is designed for gathering, cleaning, and loading the sugar beet roots from piles in the fields. It is mounted on the MTZ-2 tractor. It consists of a frame, rake apparatus, tray, cleaning device, inclined conveyer, and hydraulic operation and drive system. Seven hydraulic cylinders have been installed on the loader-cleaner.

The rake apparatus is designed for feeding the beet roots onto the tray.

The tray is for receiving and feeding the roots to the cleaning device where they are cleaned and moved to the inclined conveyer which then takes the roots from the cleaning device for transport.

All the rotating parts are driven from the tractor power selection shaft.

The process of loading the beets is done in the following way.

The MTZ-2 tractor with the beet loader-cleaner backs up to the pile. The tray conveyers, cleaner worm conveyers (shneki), and inclined conveyer are put into motion by turning on the power selection shaft. By means of the hydraulic system the rake apparatus is put into operation and it rakes the beet roots onto the tray where they are picked up by two conveyers and fed to the cleaning apparatus and from it along the inclined conveyer into the trucks.

The qualitative indicators of operation of the SOT-40A beet loader-cleaner as compared with the SNT-2.1 beet loader when loading beets harvested by the SKEM-3 beet combine are given the table in accordance with data supplied by the Central Chernozem MIS [Machine Testing Station] in 1958.

The GRB-60 unloader stacker (fig. 5) has been developed by the SKB of the Dnepropetrovsk Agricultural Machine Building Plant on the basis of the SOT-40A loader-cleaner. It is designed for unloading sugar beet roots from trucks and trailers and stacking them in piles. It has a productivity of up to 60 tons/hr.

During operation the tractor and stacker are set parallel to the pile. Trucks back up to the unloader tray, open the tail gate, and unloader rakes, rake the beets onto the horizontal conveyer of the receiving tray. The beet roots are fed from the horizontal conveyer to the inclined conveyer, which stacks the beets in a pile.

Indicators	SOT-40A	SNT-2.1
Roots not gathered and lost (%)	1.94	12.54
Roots damaged (%)	11.05	10.05
Contamination after loading (%)		
Loose soil	0.68	1.98
Soil on the roots	4.37	5.89
Loose leaves	0.07	0.85
Leaves on the roots	3.05	3.80
Losses of sugar plant bulk (%)	0.33	0.33

The BN-100 beet pile covering machine has been developed by the Ukrainian Scientific Research Institute of the Alcohol and Liquor-Vodka Industry and is designed for covering piles of sugar beets with soil. The pile covering machine consists of a frame 1, a plowshare 2, sweep (kryl'chatka) 3, a reduction unit, housing 4 with baffle 5, paw 6, mechanism regulating depth of plowshare, roller 7, and lever 8 for changing the position of the baffle.

When the tractor and pile covering machine moves by the pile, the paw lossens the surface of the ground, which is then raised up by the plow share and fed to the sweep blades. The blades catch the soil and throw it out through the opening in the sweep housing to the pile being covered. The soil is fed in the right direction by means of the baffle whose slant is regulated by a lever. Soil can be thrown to a distance of 1.5-6 meters and to a height of 5 meters.

The production of the new, more improved machines described above will make it possible to completely mechanize the harvesting of sugar beets.

FIGURE APPENDIX

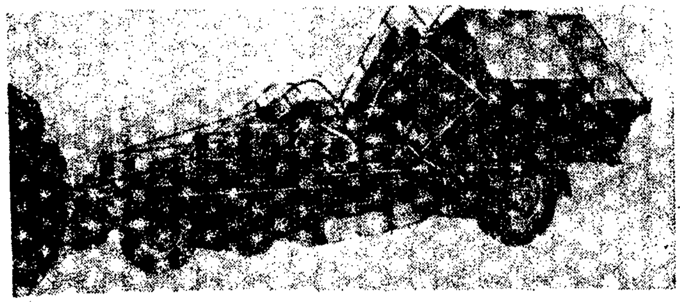

Fig. 1. SKN-1.6 Beet Harvesting Combine

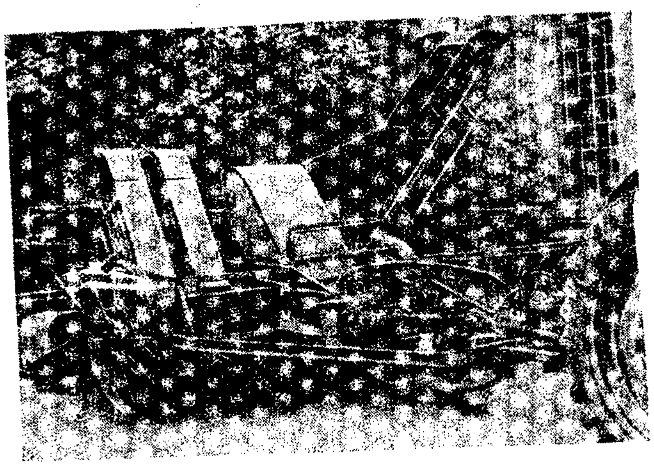

Fig. 2. SKF-2 Beet Harvesting Combine

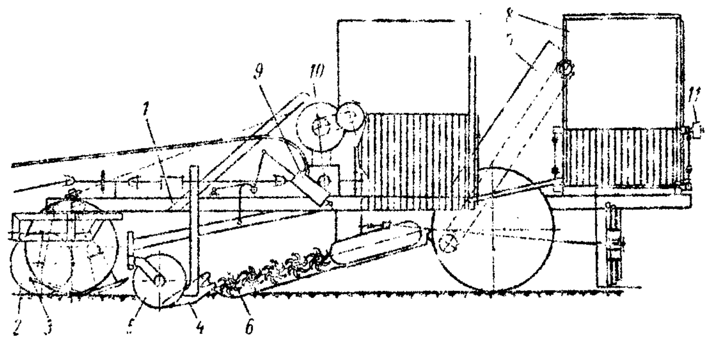

Fig. 2. Diagram of the SKD-1.6 Beet Harvesting Machine

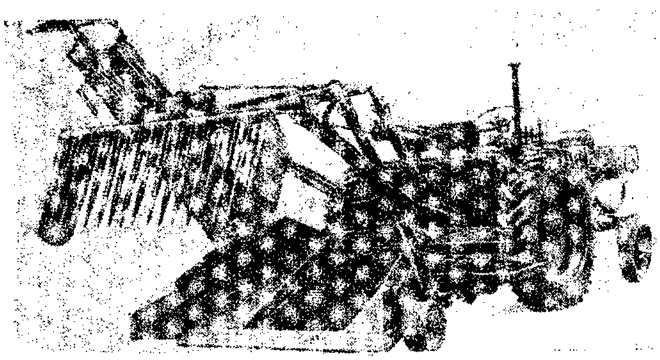

Fig. 4. SCT-[illegible] Beet Loader-Cleaner

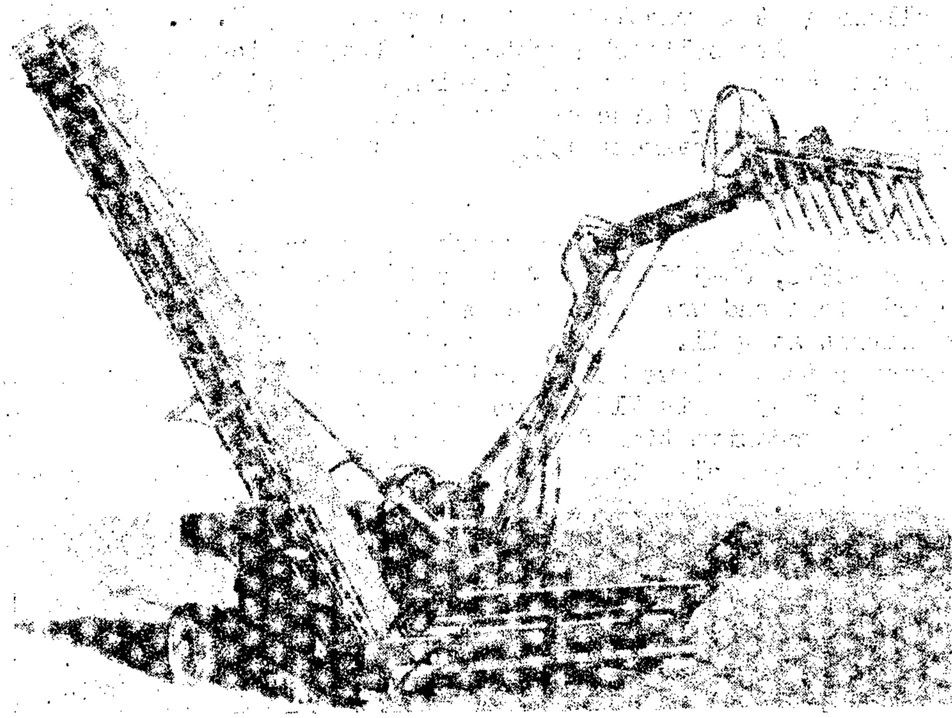

Fig. 5. GRB-60 Rake Unloader-Stacker

VII. NEW PLOWS

[Following is a translation of an article by V. I. Andreyev, Engineer, Altaysel'mash [Rubtsovsk Altay Agricultural Machine Building Plant], in the Russian-language periodical Traktory i Sel'khozmashiny (Tractors and Agricultural Machines), Moscow, No 11, November 1959, Pages 32-34.]

Prior to 1958, the Altaysel'mash Plant produced the models P5-35MA, P5-35Ts, P5-35TsU five-bottom tractor drawn plows which proved to be good plows and were sold not only in the Soviet Union but on the foreign market as well.

However these plows have a relatively high metal consumption which for the P5-35MA is 715 kg per 1 meter working width. In addition they require excessive time for technical servicing, there is a need for a coupling, and also they are not highly maneuverable because the turn radius is 5.5-7 meters.

In line with directions of the party and government, agricultural machine building plants since 1957 have begun the change to the production of more improved agricultural machines that have low metal consumption and do not require a large number to service them.

Plans of the PN4-35 mounted plow designed by the SKB [Special Design Bureau] of the Plant imeni Oktyabr'skaya Revolyutsiya were sent to the plant in 1957.

However in as much as the frame of this plow was an all-welded design from thin-walled heavy-duty sections and proved to be not sufficiently stable and completely unrepairable, the plant had the problem of developing a mounted plow free of the inadequacies noted.

The division of the chief designer has designed the PNS4-35 mounted four-bottom plow (fig. 1) which is distinguished by the fact that the frame has been assembled from completely bent I beams. Such a designed frame has made it possible with relatively little weight to achieve great stability in the plow and has made the frame capable of repair.

The PNS4-35 plow has successfully undergone plant and state tests and has been accepted for series production since the middle of 1958. It is being produced both for moldboard and moldboardless plowing according to the T. S. Mal'tsev method for which an additional set of moldboardless bottoms is provided for the plow.

Specifications of the PNS4-35 Plow

	Plow for Moldboard Plowing	Plow with Additional Set for Non-Moldboard Plowing
Bottom working width (cm)	35	35
Plow working width (cm)	140	140
Maximum plowing depth (cm)	27	40 (for non-moldboard plowing)
Productivity with a tractor speed of 4.65 km/hr (hectares/hr)	0.65	0.65
Plow weight (kg)	570	760
Spacing of attachments while plow is in motion (mm)	750	750

The plow is designed for operation in unit with the DT-54A tractor.

In 1958, state tests of the VPN-2 mounted digging-up (Vykopochnyy) plow were concluded successfully; it was put into production in place of the VP-2 tractor drawn plow and is distinguished from the latter not only in weight (600 kg lighter), but also by the fact that it has attachments both for digging up young plants (fig. 2) and for digging up seedlings (fig. 3). The attachments can be changed in the field.

The plow is designed for operation in unit with the DT-54A tractor.

Specifications of the VPN-2 Plow

Size (mm)	
Length	1,375
Width	2,900
Height	1,660
Weight of plow with both attachments (kg)	330
Productivity per day (running meters)	3,000

The Chief Design Bureau attached to the Altaysel'mash Plant is also continuing in 1959 to work on the improvement of existing plows and the creation of new designs of general and special purpose plows.

In view of the fact that the large DT-54A and T-4 crawler tractors (newly developed at the Altay Tractor Plant) cannot be loaded with a four-bottom plow on the soils of Siberia, the Altay, and Kazakhstan, it has become necessary to develop a five-bottom or even a six-bottom plow that can be loaded on these tractors.

The use of a mounted version of five- or six-bottom plows (the weight of which would not be less than 700-800 kg) is not possible, because the rear axle assembly would be greatly overloaded. Hence the Altaysel'mash Plant has decided to develop multi-bottom semi-mounted plows.

The semi-mounted plow, developed by the chief designer's division, is shown in fig. 4. The arrangement of the frame, attachments, and undercarriage are the same as that of the P5-35G experimental tractor-drawn plow and for that reason the layout of the plows will be explained simultaneously.

The plow has a flat frame made from completely bent I beams. The attachments --- the bottoms which have been unified with mounted plow bottoms, and series-produced colters or disc-type uglosnimy --- skim colters are fastened to the frame.

On the plow frame between the second and third bottoms, a field mechanism is installed which consists of a - shaped axis with non-equidimensional elbows, that are set at an angle, to which the wheels on tapered roller bearings with rubberized metallic packing are fastened. There is no support wheel on the semi-mounted plow.

On the forward part of the frame (fig. 6) the plow support is installed, by means of which the plow is joined with the tractor, so that the longitudinal connecting rods of the tractor hinge slip on the plow cross piece pins 1, and the central connecting rod be fastened on the balance arm 3 fork. After this the plow is ready for operation.

Fig. 4 is a diagram of operation of the semimounted plow together with a DT-54A tractor. The solid lines show its position when not in operation and the dotted lines --- its transport position.

In view of the fact that the plow rests on two transport wheels located near the center of gravity, there is no torsional force on the hinge and the weight exerted by the tractor on the tractor rear axle assembly does not reach 100 kg.

The plow does not have a support cylinder and the field mechanism is driven directly from the tractor hinge through the balance arm 1 (fig. 4) and the field mechanism 4 connecting rod (fig. 6).

When raising it into transport position, the ends of the central and longitudinal connecting rods almost join (point a and b of fig. 4) and for that reason the tractor can sway in a vertical direction around these points and not transmit this sway to the plow.

It turns on a king pin 2, whereupon the upper end of the balance arm 1 is joined with the king pin axis.

As a result of such a layout, the plow in transport position is connected with the tractor hinge as though by a three dimensional link and this makes it possible to maintain a regular transport clearance during turns and when the tractor is moving over uneven ground.

In order to release the plow, the tractor driver sets the handle and the plow drops by the force of its own weight, whereupon the balance arm 1 moving like a watch hand lets up on the connecting rod and the field mechanism pivot turns as much as the screw 4 permits, whereupon the left wheel 6 will move along the field, restricting the amount of drop, and the right wheel 5 is raised above the upper edge of the moldboards.

The extent of drop of the front part is restricted either by the length of the vertical cross stays of the tractor hinge or by the collar on the cylinder rod. Non alignment, as on mounted plows, is eliminated by regulating the vertical cross stays of the tractor hinge.

In as much as when it is not in transport position, the field mechanism connecting rod sags, the sway of the tractor does not affect the plow.

A semi-mounted plow can easily be made into the P5-35G tractor-drawn plow or into a semi-tractor drawn plow. In order to do this remove the support and install a coupling in its place (fig. 5), having connected it by a connecting rod with the field mechanism, and install a support wheel on the first plow beam.

The plow is hitched to the tractor for operation and the support cylinder is removed from the tractor and installed on brackets. When the cylinder rod is moved forward as far as possible, the plow is in transport position and the plow frame when raised and lowered remains in a horizontal position, because the coupling is connected directly to the field mechanism. In transport position, the plow rests on three points: on two wheels and on the coupling.

The extent of drop of the plow is fixed by the left field wheel, by the position of the coupling and the position of the support wheel. The position of the left wheel and the coupling which is connected with it are regulated by a screw.

In as much as the plow is connected with the tractor only at one point, it moves along the ground independent of the tractor. It was noted during state tests at the Georgian MIS [Machine Testing Station] that there is a tendency for the coupling to buckle when the plow was moving over uneven ground. In order to eliminate this, a ball-type connection of the link with the coupling has now been utilized.

During plant and state tests, the P5-35G plow proved to be durable, easy to regulate, and convenient to service. The plow can be equipped with series-produced colters. The weight of the P5-35G (both the semi-mounted and tractor drawn modifications) is 940 kg, i.e., 300 kg less than the P5-35MA plow; traction resistance is 5 percent less and consequently fuel consumption is reduced and productivity raised.

The universality of the P5-35G plow should be noted especially. The plow can operate with any number of bottoms --- from 1 to 5, with any tractor having hydraulics, can be moved even by a tractor without hydraulic equipment, and finally can be taken off by hand when the hydraulic system is out of order. Other systems of both mounted and semi-mounted plows have none of these things.

The chief designer's division is doing a great amount of work on further modernizing agricultural machines in addition to what is being done in the field of creating new designs of plows. For example, the weight of the P5-35MA tractor drawn plow was reduced by approximately 30 kg during 1958. In 1959, they succeeded in reducing the weight of the plow by another 50 kg.

At the present time a better designed tractor drawn plow with a shortened frame and a hydraulically driven field mechanism is undergoing control tests at a number of machine testing stations.

FIGURE APPENDIX

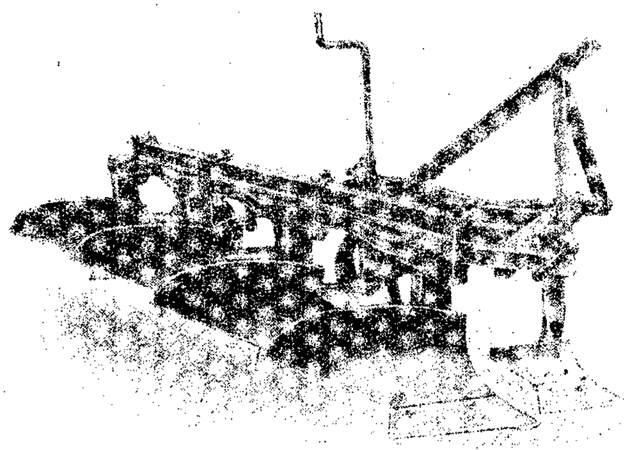

Fig. 1. PNS4-35 Plow.

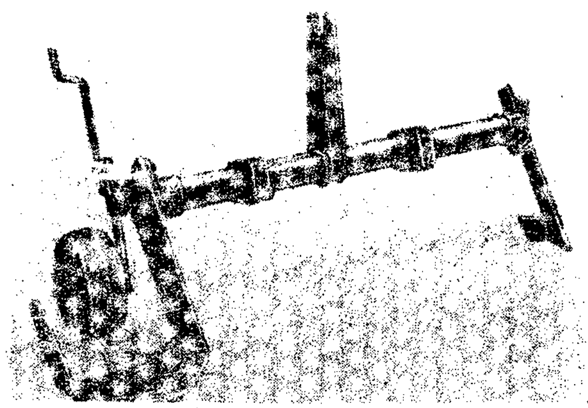

Fig. 2. VPN-2 Digging-Up Plow with Attachment for Digging-Up Young Plants.

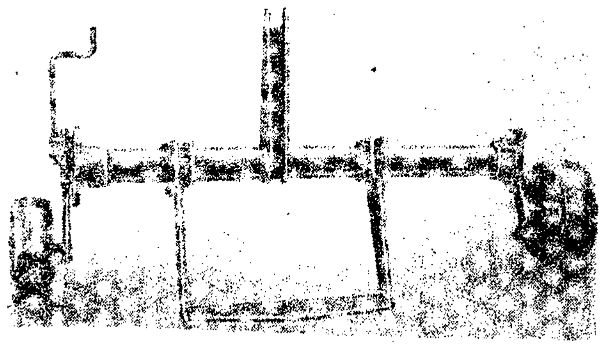

Fig. 3. VPN-2 Digging-Up Plow with Attachment for Digging-Up Seedlings.

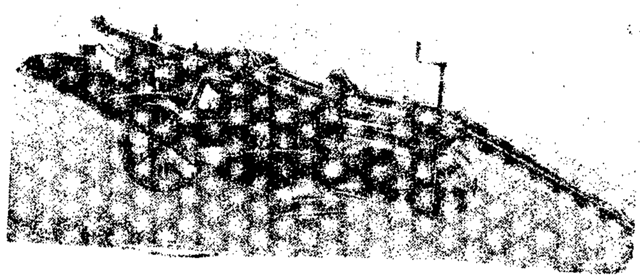

Fig. 5. PS-35G Plow -- Tractor Drawn Modification.

VIII. ANALYSIS OF CONSTANT FLOW PRODUCTION AT TRACTOR AND AGRICULTURAL MACHINE BUILDING PLANTS

[Following is a translation of an article by P. I. Minin and V. K. Shumilkin in the Russian-language periodical Traktory i Sel'khozmashiny (Tractors and Agricultural Machines), Moscow, No 11, November 1959, Pages 38-41.]

Significant changes in the production structure and significant technical progress are foreseen in the plan of development of the USSR economy during 1959-1965. This will be ensured first of all by the more rapid development of machine building. The Seven Year Plan foresees the equipment of enterprises with new machinery and a fundamental improvement in technology and production organization. This will be a decisive factor in the growth of labor productivity, will lighten labor conditions, and will ensure the possibility of a further shortening of the working day. The June Plenum of the Central Committee CPSU has discussed and accepted important decisions in the area of specialization and automation of production.

Important possibilities for the development of tractor building and agricultural machine building have been laid in the further expansion of the use of the constant flow method of operation, in improving the existing organization of constant-flow production, in the change from elementary forms of constant flow operation to more sophisticated methods, and in the specialization and automation of production of tractors, agricultural machines, and implements.

As has been indicated in the decision of the June Plenum of the Central Committee CPSU, these reserves for the further expansion of production specialization are present especially where they are favorable conditions for the use of constant flow methods of operation of the most advanced kind.

A special investigation was organized by NIITraktorosel'khozmash [Scientific Research Institute of Tractor and Agricultural Machine Building] to find means of raising the efficiency of constant flow operation in its different types and forms. The investigation was carried out by the Production Organization Chair of the Moscow Automotive Mechanics Institute.

The investigation of the state of constant flow production organization and the reserves on constant flow lines was made in the basic shops of the following tractor plants: Khar'kov, Minsk, and Vladimir and at the following agricultural machine building plants: Rostsel'mash, Lyubertsy imeni Ukhtomskiy, Krasnaya Zvezda, and Krasnyy Aksay. The results of the investigation which are typical for the indicated branches of machine building are reported in this article.

The composite findings of the investigation of constant flow organization at 64 basic production shops and at 198 sections in tractor and agricultural machine building plants cited above have been classified according to basic features of constant flow lines and have been set forth in table 1.

Table 1 [Part 1]

Composite Data from the Results of an Investigation of the Status of the Organizational-Technical Level of Constant-Flow Production Organization at Soviet Tractor and Agricultural Machine Building Plants (the Status as of Feb-May 1958)

Plant	Total Constant Flow Lines in Basic Production Covered by Investigation	Number of Subassemblies or Parts Alloted to Constant-Flow Lines	Number of Operations Performed on Constant Flow Lines	Number of Working Places on Constant-Flow Lines	Number of Workers Employed on Constant Flow Lines
Khar'kov Tractor	173/5	897[1]	3,465	2,528	2,139
Minsk Tractor MTZ	109/15	490	1,832	1,311	971
Vladimir Tractor VTZ	59/---	---	857	443	388
Rostsel'mash	62/15	140	451	423	582
Krasnaya Zvezda	51/13	80[2]	311	422	42[illegible]
Lyubertsy imeni Ukhtomskiy	45/11	481[3]	376	527[4]	398[5]
Krasnyy Aksay	25/5	49[6]	174	189	260
Total	524/64*	---	7,466	5,843	5,159

Table 1 [Part 2]

Plant	Specification of Constant-Flow Lines					
	Type of Production				Type of Movement of Workpiece	
	Constant-Flow Mass		Constant-Flow Series		Continuous Action Constant Flow (Duration of Operation Synchronized with Cycle	Non-Continuous Action Constant Flow (Duration of Operation not Synchronized with Cycle
	Non-Automated	Automated	Variable Constant-Flow with Resetup of Line for each part	Group Constant-Flow (without Resetup for each Part)		
Khar'kov Tractor	126	1	22	24	15	158
Minsk Tractor MTZ	71	2	7	29	3	106
Vladimir Tractor VTZ	58	1	--	--	2	57
Rostsel'mash	34	6	13	9	12	50
Krasnaya Zvezda	21	2	4	24	2	49
Lyubertsy imeni Ukhtomskiy	12	4	20	9	9	36
Krasnyy Aksay	12	-	6	7	-	25
Total	334	16	72	102	43	481

Table 1 [Part 3]

Method of Maintaining Operating Rhythm

	With Regulated Operating Rhythm	With Operating Rhythm Maintained by Workers
Khar'kov Tractor	14	159
Minsk Tractor MTZ	4	105
Vladimir Tractor VTZ	1	58
Rostsel'mash	18	44
Krasnaya Zvezda	2	49
Lyubertsy imeni Ukhtomskiy	9	36
Krasnyy Aksay	4	21
Total	52	472

Table 1 [Part 4]

Specifications of Constant Flow Lines

Plant	Transport Conveyers	Distributor Conveyers	Continuously Moving Conveyers	Intermittent Conveyers	With Hoist Transport Equipment (Overhead Crane, Telpher, Monorail)	Roller Conveyer
Khar'kov Tractor	5	9	16	—	33	25
Minsk Tractor MTZ	4	-	2	5	28	23
Vladimir Tractor VTZ	1	-	-	6	17	22
Rostsel'mash	1	-	12	-	19	3
Krasnaya Zvezda	8	-	11	4	14	-
Lyubertsy imeni Ukhtomskiy	6	1	6	-	14	4
Krasnyy Aksay	5	2	3	-	11	1
Total	30	12	50	15	136	78

Table 1 [Part 5]

Specifications of Constant-Flow Lines

Plants	Movement of Workpiece on Carts; on own Wheels	Hand Carrying of Workpiece from one Operation to another	Stationary Workpiece, when not it, but Workers Move Along Line Doing Operations in Succession	Number of Shops Having Constant Flow Lines[7]
Khar'kov Tractor	33	98	1	15/4
Minsk Tractor MTZ	72	57	-	12/4
Vladimir Tractor VTZ	1	32	-	5/-
Rostsel'-mash	12	23	-	9/6
Krasnaya Zvezda	28	27	-	7/4
Lyubertsy imeni Ukhtomskiy	27	5	-	9/4
Krasnyy Aksay	5	14	-	7/3
Total	178	256	1	64/2

* The denominator indicates the number of constant-flow lines in initial processing shops and the numerator, their total number.

1. Without parts cast in malleable cast iron shop.
2. Without parts cast in gray and malleable cast iron shops.
3. Without parts cast in gray and malleable cast iron shops.
4. Without working places in foundries
5. Without workers on constant-flow lines in foundries.
6. Without parts cast in gray and malleable cast iron foundries.
7. The numerator gives the total number of shops in which the constant flow lines were studied and the denominator, the number of primary processing shops.

Of the 524 constant flow lines covered by the investigation, 460 have been organized in machine assembly shops and the rest in initial processing shops, including 28 constant flow lines in foundries.

An analysis of the factors influencing the degree of constant-flow (potochnost') in initial processing shops shows that the chief cause hindering the extension of constant flow organization of work in the press and forging shops and in the die-forging shops of the plants cited above is the inadequate scale of output, the inadequate unification and standardization of die-forged and forged parts, and the inadequate specialization of their production. With the high productivity existing at press and forging equipment plants, for the efficient organization of constant flow operation it is necessary, by the unification and standardization of parts and their structural elements, to sharply increase the scale of output of technologically similar products in press and forging shops. This is the most important basic condition for organizing specialized production and constant-flow operation. Even more extensive possibilities for the organization of constant flow operation exist with the organization of centralized foundries and press and forging shops and plants that take care of several enterprises. Thus there is the possibility of greater unification of parts produced for the different enterprises. This conclusion is convincingly substantiated by the findings of the investigation and the practice of foreign firms in more technically developed countries.

On the whole, the degree of production encompassed by constant-flow organization is characterized by the coefficients of constant flow cited in table 2 for tractor and agricultural machine building plants.

For the sake of comparison it might be pointed out that the constant flow coefficient at Soviet motor vehicle plants averages 90 percent.

The constant flow coefficients fluctuate significantly for different shops. For example, at KhTZ [Khar'kov Tractor Plant], it fluctuates from 19.3 to 100 percent, at the Rostsel'mash Plant from 15.8 to 40.5 percent, and at the Krasnyy Aksay Plant from 14.6 to 58 percent.

From the data cited in table 2 it is evident that at agricultural machine building plants, basic production organized by constant flow methods is two times less than at tractor plants. The data cited concerning the extent of constant flow testify to the fact that at the plants indicated, especially at agricultural machine building plants, there are great possibilities for further expanding constant flow production by the specialization of production, the basis of which is the unification and standardization of products manufactured by the plants. Efficient automation and complete mechanization of production processes is possible only at specialized enterprises.

Table 2

Plants	Extent of Constant Flow in Percentages of the Total Number of Parts
Tractor:	
Altay	64.7
Chelyabinsk	64.0
Khar'kov	63.5
Stalingrad	63.5
Vladimir	63.0
Minsk	55.7
Lipetsk	50.2
Average for tractor plants	59.7
Agricultural Machine Building:	
Rostsel'mash	21.4
Krasnyy Aksay	29.0
Krasnaya Zvezda, [Lyubertsy] imeni Ukhtomskiy	24.1
Constant flow coefficient for agricultural machine building plants averages	23.4

It is evident from an analysis of the data in table 1 that at tractor plants, which manufacture a structurally and technologically more complex product, they perform a greater number of operations on constant-flow lines especially machining. Thus at KhTZ, MTZ [Minsk Tractor Plant], and VTZ [Vladimir Tractor Plant], 17 operations are performed on the average on one constant flow line, whereas at agricultural machine building plants --- an average of 5-6 operations. It follows from this that at agricultural machine building plants, the introduction of new machinery should be directed to the more extensive use of unit-type machine tools which ensure a rise in productivity as compared with poorly organized constant flow lines.

On the whole constant-flow lines have been organized better at tractor plants and this is corraborated by the fact that the number of worker-operators on the lines, as a rule, is fewer than the number of working places, because certain workers do not one, but two or more operations, changing during the shift from one working place to the other.

For example, on the line for machining crankshafts at KhTZ, 40 people took care of 64 working places; on the line for machining camshafts, there were 12 people at 27 working places; and on the line for machining oil pumps, there were 8 people at 26 working places, etc.

At agricultural machine building plants, especially at the Rostsel'mash and Krasnyy Aksay plants, on a number of constant-flow lines the number of worker-operators exceed the number of working places on the line. For example, on the line for assembling the KUTS-4 cultivator frame, there were 35 people at 18 working places; on the line for machining cultivator teeth, there were 10 people at 3 working places. At the Rostsel'mash Plant on the chassis line, there were 18 people at 8 working places; on the main assembly conveyer, 92 people at 25 working places.

This can be explained by the basic lack of hoist and transport equipment and also in a number of instances by the unsatisfactory separation of production processes done on the constant flow lines, i.e. by the lower level of production organization and the inadequate equipment.

Of the 524 constant-flow lines examined during the investigation at the tractor and agricultural machine building plants indicated above, 334 lines or 63.8 percent are constant flow-mass production, unautomated lines. A sufficiently large volume of production is necessary for organizing efficient automatic lines. For this reason, automatic constant flow lines in the branches of machine building indicated have until now not been widespread, for example at the Khar'kov, Minsk, and Vladimir Tractor Plants, there are three automatic lines for machining cylinder heads and 12 automatic constant flow lines at agricultural machine building plants, including lines for machining nuts and bolts: 6 at the Rostsel'mash Plant, 4 at the Plant imeni Ukhtomskiy, and 2 at the Krasnaya Zvezda Plant.

At series-production enterprises and sections, series-constant-flow lines and the group method of machining parts have enormous importance in raising labor productivity. The findings of the investigation show that variable-constant-flow and group-constant flow lines are not used as extensively as they should be at tractor plants. They are employed relatively more extensively at agricultural machine building plants.

At the tractor plants (KhTZ and MTZ), constant-flow series-production lines comprise 10.8 percent of the total number of constant flow lines.

There is a different situation at the agricultural machine building plants, where, with the exception of the Rostsel'mash Plant, constant-flow series production lines are more widespread than constant flow mass production lines. At the Rostsel'mash Plant they comprise 35 percent of the total number of constant flow lines, 50 percent at the Krasnyy Aksay Plant, 55 percent at the Krasnaya Zvezda, and 64 percent at the Plant imeni Ukhtomskiy.

The investigation has shown that the possibilities for further expanding the use of constant flow series production lines is far from exhausted, especially at agricultural machine building plants. However with the present state of standardization and unification, the more extensive use of constant flow methods of operation cannot be developed further.

Constant flow series production lines in agricultural machine building are relatively more widespread and this can be explained primarily by the small machine tool capacity of agricultural machinery parts and the unsatisfactory scale of output and as a result the organization of constant flow lines for one type of part is not economically feasible. There are great possibilities, until now almost completely not utilized, at agricultural machine building plants for organizing the group machining of a number of parts according to the method of engineer Mitrofanov.

At agricultural machine building plants 5 parts on the average are alloted to each variable constant flow line and 2-3 parts to each group constant flow line, i.e. approximately the same as at tractor plants.

It is very important to note that at the plants examined, about 92 percent of the constant flow lines are non-continuous action constant flow lines; the duration of the different operations done on these lines has not been synchronized with the operating cycle of constant flow lines.

The remaining 8 percent of the lines are continuous action constant flow lines. Basically these are continuous action constant flow lines for assembling subassemblies and parts, constant flow lines in foundries, and automatic lines.

More than 90 percent of the constant flow lines at tractor and agricultural machine building plants operate with an open work rhythm, maintained by the workers themselves. The remaining 10 percent of the constant flow lines operate with a regulated work rhythm maintained in accordance with the assigned speed of the conveyer, thus the constant flow rhythm is observed at each working place. Lines with a regulated work rhythm have a higher level of organization of work and a higher productivity.

On the whole constant flow lines have been inadequately mechanized. Of the 524 constant flow lines only 107 have conveyers, including 65 work conveyers on which work is done directly; only 50 of the conveyers are continuous action types. There are 32 transport conveyers.

Such very simple transport equipment as roller conveyers are not widespread, only about 15 percent of the constant flow lines have been equipped with these.

Hoist and transport equipment is clearly inadequate on non-continuous action constant flow lines; more than half of them do not have any kind of mechanization equipment.

All of this goes to explain the extensive use on constant flow lines of tractor and agricultural machine building plants of manual labor in moving parts being machined from one operation to another. On these lines as a rule there is low labor productivity and a completely inadequate utilization coefficient of equipment.

The data cited makes it clear where and by what means it is possible to receive a significant effect, to raise labor productivity, to obtain better use of equipment with a given level of standardization and production specialization.

An analysis of the constant flow lines shows that non-continuous action, single type part (odnonomenklaturnyye), constant flow, mass production lines are more widespread at tractor plants and multi-type part (mnogonomenklaturnyye), variable constant flow and group constant flow lines at agricultural machine building plants.

Now non-continuous action constant flow, single and multi-type part constant flow lines are standard for plants in the branches of machine building indicated.

Certain standard constant flow lines were subjected to a detailed examination. It is well known that the duration of various operations, done on non-continuous action lines, are different. It does not equal the computed operating cycle of the line, and as a result a complete proportionality of the processes is not ensured.

Synchronousness of an operation done on a constant flow line is characterized by the load coefficient of the equipment installed in the line.

For example at the Vladimir Tractor Plant on a non-continuous action constant flow line for machining connecting rods, the load coefficient according to the findings of the investigations was 50 percent, on the line for flywheels 45 percent, on the line for camshafts 40 percent, and on the line for crankshafts 55 percent.

There are approximately the same load coefficients on similar non-continuous action constant flow lines at other tractor plants. In general this characterizes the low level of synchronization of processes and the inadequate use of equipment in the constant flow lines indicated. Basically this depends on an insufficient volume of production and on the low level of production organization. At the Rostsel'mash and Krasnyy Aksay plants, according to the findings of the investigation, the synchronization of processes on standard constant flow lines is characterized by a load coefficient within limits from 71 to 86 percent, i.e., somewhat higher than at tractor plants. However this depends on the greater volume of output and not on the better organization of production.

For various operations done on constant flow lines, the duration of which does not equal the computed work cycle of the line, there is a more or less significant divergence from the average load coefficient for the line.

Thus, the average divergence or coefficient of non-proportionality on the non-continuous action constant flow line for machining connecting rods at the Vladimir Tractor Plant is 44 percent and the maximum divergence from the average load is 96 percent.

The significant reserves, that exist on non-continuous action constant flow lines, are characterized also by the coefficients of discontinuity of the processes, done on the constant flow lines, which show how many times the time between operations is greater than the machining time. Table 3 contains the findings made during the investigation concerning the coefficients of discontinuity for certain plants.

Table 3

Plant	Name of Line	Total duration of Machining Cycle (min.)	Labor Consumption for Machining (min.)	Discontinuity Coefficient
KhTZ	Cylinder blocks	1,500	233.4	6.44
	Camshaft	225	60.7	3.71
	Connecting rod and cover	310	46.7	6.15
	Cylinder sleeve	200	19.2	10.4
RSM	Drive sprocket	25	4.65	5.3
	Hubs	66	10.9	6.0
Krasnyy Aksay	Beam bracket	64	2.01	8.0

The data in table 3 about the degree of nonproportionality and discontinuity of the processes show the existence of large reserves on non-continuous action constant flow lines, which can be used to a significant extent with the better organization of their operation. In order to do this a careful examination of all the elements of constant flow production is required, the implementation of changes in the operation of the lines as regards each operation and most important, the establishment and strict observance of an organized regulation of operation and servicing of constant flow lines.

The findings of the investigation show that the constant flow lines both at the tractor plants and at the agricultural machine building plants do not operate rhythmically. Thus after a detailed investigation of relatively well organized constant flow, the following coefficients of actual operating rhythm were established (table 4), which could be raised with a better organization of servicing and greater mechanization.

Table 4

Plants	Name of Line	Coefficients of Actual Operating Rhythm
KhTZ	Crankshafts	78.5
	Cylinder blocks	88.7
RSM	Drive sprocket	88.6
	Thrashing machine crankshaft	84.5
	Drum shaft	80.6

One of the main inadequacies in the organization of constant flow lines is the non-observance of the basic conditions of their normal operation, to wit:

a/ non-observance of established production operations when a constant flow line is organized and its unsystematic change for various operations done on constant flow production;

b/ non-observance of the method of servicing constant flow lines with blanks, parts, tools, transport, and repair, etc.

c/ non-observance of a work procedure regulating the actions of the different workers who are assigned several operation in constant flow-production.

d/ the lack of varied inter-shop, inter-line, and intra-line stocks of materials strictly maintained at a set level. One of the main causes of inadequacies in the operation of constant flow lines is underestimation of the role and significance of reserve stocks of material and violation of established norms of reserve stocks. It is impossible to deny the decisive significance of the factors indicated. However they are violated everywhere and as a result there is disorganization in the operation of constant flow lines.

When there is strict observance of the elementary but extremely important rules enumerated above, without which normal operation of constant flow lines is generally impossible, a sharp increase in labor productivity, a rise in the extent of the operating rhythm and efficiency of operation of existing constant flow lines is possible often by organizational measures alone without substantial material expenditures. Hence it follows that for improving the organization and raising the efficiency of operation on the overwhelming majority of existing constant flow lines, an improvement of their organizational-technical level, and perfecting the organization of operation on the more widespread single- and multi-type part non-continuous action constant flow lines are the most important tasks.

The high production rhythmic operation of a non-continuous action constant flow line is possible only on the condition that there is strict observance of a so-called "advertising to improve the organization of line operation, the essence of which is included in the following:

a/ for workers not engaged fully in one operation it is necessary to select additional operations with account taken that the sum of piece work time be approximately equal to the computed operation cycle of the constant flow line. When this is done, it is necessary to establish and strictly observe a graph of the work order which determines the periods of worker change from one operation to the other;

b/ to establish and strictly observe periodicity in servicing lines; when determining periodicity, a short more efficient periodicity should be selected; for average parts the duration of the periods of servicing is recommended at 1-2 hours and for small parts at 4-8 hours.

c/ at the beginning of a shift, constant flow lines should be provided with blanks, which should be supplied in definite amounts to a definite place and it is necessary to use suitable packing and transport equipment;

d/ to establish and strictly observe a compulsory change of tools which should be done after definite periods of time; the tool grinding should be centralized and done by qualified tool grinders who are paid in accordance with a time and bonus system; there should be reserve sets of tools at all the working places.

e/ setup of equipment, delivery of blanks and parts, replenishment of reserve stocks at a set level, removal of machined parts, pick-up of chips, small scale repair and other such work should be done by workers in the preparatory shifts who work according to a schedule set for them that is in conformity with the time of operation of the basic shifts; underestimation of the importance of preparatory shifts and their improper organization has an adverse effect on the operation of constant flow lines;

f/ it is necessary to keep the right amount of so-called turnover reserve stocks of materials (oborotnyye zadely), that are created between adjoining non-synchronized operations. The availability of these reserve stocks makes possible the rhythmic operation of the entire constant flow line; without definite turnover reserve stocks normal operation and the smooth output of non-continuous action constant flow lines is impossible;

g/ in our opinion it is worthwhile to introduce a time and bonus system of pay on smoothly operating constant flow lines.

The observance of all these conditions, which are well known to most people but not adhered to, is not an easy thing and requires the approval and efforts of all production personnel. Without a radical change and decisive strengthening of the entire system of organization of constant flow operation, it is impossible to achieve substantial results. This was discussed in the decisions of the June Plenum of the Central Committee CPSU.

Tractor and agricultural machine building plants are doing a great amount of work in the direction of technical progress of production. However the results of this work compared with the enormous possibilities that exist is still not satisfactory.

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